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REMARKS

This paper is presented in response to the final official action dated July 12, 2006, wherein: (a) claims 1-18 were pending; (b) claims 1, 8-10, and 14 were rejected under 35 USC § 103(a) as obvious over Kalbitzer U.S. Patent No. 4,764,432 ("Kalbitzer") in view of Kusunoki U.S. Patent No. 5,336,904 ("Kusunoki"); (c) claims 1-3, 6-10, and 14-17 were rejected under § 103(a) as obvious over Strain U.S. Patent No. 4,585,299 ("Strain") in view of Kalnitsky et al. U.S. Patent No. 4,934,774, ("Kalnitsky"); (d) claims 1-10 and 14-17 were rejected under § 103(a) as obvious over Strain in view of Kalnitsky and Kase et al. U.S. Patent No. 5,145,794, ("Kase"); (e) claims 1-11 and 14-18 were rejected under § 103(a) as obvious over Strain in view of Kalnitsky and Kase, further in view of Koblinger et al. U.S. Patent No. 4,980,317, ("Koblinger") and Coronel et al. U.S. Patent No. 5,930,585, ("Coronel"); (f) claims 1, 2, 7-10, and 14-16 were rejected under § 103(a) as obvious over Dood et al. "Amorphous silicon waveguides for microphotonics," J. Appl. Phys., vol. 92(2), p. 649-53 ("Dood") in view of Kusunoki; (g) claims 1-3 and 6-18 were rejected under § 103(a) as obvious over Dood and Kusunoki in view of Strain, Kalnitsky, and Kase; and, (h) claims 1-18 have been rejected under § 103(a) as obvious over Dood and Kusunoki in view of Strain, Kalnitsky, and Kase, further in view of Koblinger and Coronel.

Reconsideration and withdrawal of the rejections are respectfully requested in view of the following remarks.

I. The 35 USC § 103(a) Rejections Are Traversed

Various combinations of claims 1-18 were rejected under 35 USC § 103(a) as obvious over various combinations of the cited publications. A response to each of the obviousness rejections is set forth below.

The prior art references applied in the various rejections were discussed in the remarks previously submitted (April 28, 2006), and the discussion of the references is not repeated in this paper.

A. Proper Basis for a § 103(a) Rejection

To establish a *prima facie* case of obviousness, the PTO must satisfy three basic criteria. First, the combined disclosure of the prior art references must teach or suggest all of the claim limitations. Second, there must be some suggestion or motivation to modify or combine the teachings in the art to make the precise combination recited in the claims. Finally, a person having ordinary skill in the art must have a reasonable expectation of success when combining or modifying the disclosures of the references. The suggestion or motivation to make the claimed invention and the reasonable expectation of success must

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both be derived from the prior art, and not from the application's disclosure. See MPEP §§ 2142-43.

B. The Official Action Fails to Sufficiently Support Its Obviousness Determinations

The obviousness rejections of the official action impermissibly rely upon hindsight reconstruction. The motivation-suggestion-teaching test prevents a hindsight-driven conclusion of obviousness by requiring that a rejection set forth "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 987-88 (Fed. Cir. 2006). Specifically, "particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed." *In re Kotzab*, 217 F.3d 1365, 1371 (Fed. Cir. 2000). In making such findings, conclusory statements are insufficient. *Kahn*, 441 F.3d at 988 (citing *In re Lee*, 277 F.3d 1338, 1345 (Fed. Cir. 2002) ("The board cannot rely on conclusory statements when dealing with particular combinations of prior art and specific claims, but must set forth the rationale on which it relies.)); accord *Ex Parte Yoshii*, 2004 WL 77190, slip op. at 8, 11 (BPAI 2004) (Appeal No. 2001-1907) (finding as conclusory and insufficient to support a proposed combination the examiner's statement that the skilled artisan would have been motivated to combine prior art references with an expectation of success based on the prior art teachings and an unsupported assertion that no undesirable properties would result).

These requirements protecting against hindsight are based on "the unremarkable premise that legal determinations of obviousness . . . should be based on evidence rather than on mere speculations or conjecture" as well as the need to develop a record permitting meaningful judicial review. *Alza Corp. v. Mylan Laboratories, Inc.*, No. 06-1019, slip op. at 5-6 (Fed. Cir. September 6, 2006); see also *In re Lee*, 277 F.3d at 1342.

For each of the various obviousness rejections, the official action sets forth elements that are disclosed in the various publications, but only makes the conclusory statement that "it would have been obvious to modify" the cited publications in the manner proposed in the action with a reasonable expectation of success. See the action, pp. 2-7.

In some instances, the rejections provide cursory support for the reasonable expectation of success based on the "teachings" of a reference or some particular aspect of a reference. However, these statements related to the reasonable expectation of success (whether or not adequate therefor) are irrelevant with respect to the required showing for a motivation to combine references, because a proper motivation to combine and a reasonable expectation of success are *two distinct elements of a prima facie* case of obviousness. See Section I.A.

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In other instances, the rejections assert that the combined references are in analogous arts. The teachings of references in analogous art may be properly considered together. *In re Oetiker*, 977 F.2d 1443, 1447 (Fed. Cir. 1992) ("In order to rely on a reference as a basis for rejection of an applicant's invention, the reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the inventor was concerned."). While a finding that references are non-analogous is sufficient to defeat a *prima facie* case of obviousness (*id.*), a finding that references are analogous says nothing concerning the *reasons why* the skilled artisan would select the particular combination advocated in the rejection.

Thus, with respect to the motivation to modify/combine element of a *prima facie* case of obviousness, the official action relies solely on conclusory statements. Accordingly, all of the obviousness rejections should be withdrawn as being impermissibly based on hindsight.

C. Rejection of Claims 1, 8-10, and 14 over Kalbitzer in view of Kusunoki

This rejection is a classic example of an improper combination based on a teaching away from the combination in the references. See MPEP § 2145(X)(D)(2) (citing *In re Grasselli*, 713 F.2d 731 (Fed. Cir. 1983)). "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, . . . would be led in a direction divergent from the path that was taken by the applicant." *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994).

In *Grasselli*, the claims at issue were directed to a catalyst composition that recited iron and an alkali metal as components (among others). *Grasselli*, 713 F.2d at 733. One reference ("Hiroki") was directed to a catalyst and taught the interchangeability of an alkali metal and antimony. *Id.* at 744. A second reference ("Sennewald"; also directed to a catalyst) (1) taught the inclusion of iron, (2) was silent with respect to an alkali metal, and (3) excluded antimony. *Id.* The court found that it was impermissible to select an alkali metal from Hiroki for combination with the iron from Sennewald in view of the exclusion of antimony in Sennewald:

The board's error, in rejecting claims over Hiroki and Sennewald, lies in its failure to recognize the express prohibition against inclusion of antimony in Sennewald's catalysts. In contrast, we have Hiroki's express statement as to interchangeability of alkali metal and antimony with the same beneficial result. Logical inquiry into the express statements of these two references would suggest lack of interchangeability of the respective catalytic components. Appellants' successful combination of alkali metal, iron, bismuth and molybdenum for a catalyst composition is contrary to these art descriptions.

Id. at 744-45.

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The present rejection illustrates a case of teaching away similar to *Grasselli*. The action asserts that it would have been obvious to select the silicon ion species from Kusonoki for use in the ion implantation process of Kalbitzer. See p. 2 of the action. Yet, Kalbitzer excludes silicon (atomic mass = 28.1) from its contemplated ions for amorphization because it expressly discloses the use of ions having an atomic mass of 30 or more. Kalbitzer, col. 4, lines 8-9. Kusonoki discloses silicon and germanium (atomic mass = 72.6) as two ion species used to make an amorphous silicon layer. Kusonoki, col. 11, lines 33-36. In *Grasselli*, the court found that it was impermissible to select for combination from one reference the chemical species (i.e., an alkali metal) that was equivalent to the chemical species (i.e., antimony) that was excluded by the second reference. See *supra*. If it is impermissible to select a species that is equivalent to an excluded species, then it must also be impermissible to select the excluded species itself (i.e., silicon in the present rejection).

Thus, Kalbitzer teaches away from the use of silicon ions like those in Kusonoki, and Kusonoki provides no basis to conclude silicon is nonetheless acceptable in spite of Kalbitzer's explicit teaching. See *Grasselli*, 713 F.2d at 744-45. If anything, assuming that Kalbitzer and Kusonoki were properly combinable in the first instance, the skilled artisan would only be motivated to use germanium ions, as such a choice would be consistent with both teachings. See *Gurley*, 27 F.3d at 553.

D. Rejection of Claims 1-3, 6-10, and 14-17 over Strain in view of Kalnitsky

The action asserts that "it would have been obvious to modify the process of forming a waveguide taught by Strain '299 by using Si ion doping taught by Kalnitsky et al. '774." See p. 4 of the action. Thus, the action essentially asserts the obviousness of a combination in which (1) a silicon substrate is provided (as taught by Strain), (2) a dopant selected from boron, phosphorous, germanium, and arsenic is implanted into the silicon substrate (as taught by Strain), (3) a silicon dopant is also implanted into the silicon substrate (as taught by Kalnitsky), and (4) the silicon substrate is then oxidized to form an silicon dioxide region containing the dopants (as taught by Strain). Alternatively, the action could be referring to a combination in which (1) a silicon substrate is first provided (as taught by Strain), (2) a silicon dopant is implanted into the silicon substrate (as taught by Kalnitsky; in place of the boron, phosphorous, germanium, and arsenic dopants of Strain), and (3) the silicon substrate is then oxidized to form an silicon dioxide region containing the silicon dopant (as taught by Strain).

Regardless of whether Strain and Kalnitsky may be properly considered together, there are no "reason[s] the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed." *In re Kotzab*, 217 F.3d at 1371. Further, a skilled artisan considering the combined teachings of Strain and Kalnitsky "would [have been] led in a direction divergent from the path that was taken by the applicant." *In re Gurley*, 27 F.3d at 553.

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Strain and Kalnitsky do not suggest the desirability of more than one dopant ion (i.e., silicon and one of boron, phosphorous, germanium, and arsenic, as in the first hypothetical combination above). While Strain teaches that different ions can be used, only one type is used in a given embodiment. See Strain, col. 4, lines 33-36 ("Ions of a *selected dopant* such as arsenic, boron, germanium or phosphorous are implanted relatively deeply into the underlying silicon (e.g., one micron) using suitable energy levels." (emphasis added)). Similarly, Kalnitsky teaches only the implantation of a single ion species: silicon.

Nor does anything in the combination of Strain and Kalnitsky suggest that silicon is an equivalent of and exchangeable with boron, phosphorous, germanium, or arsenic (i.e., as in the second hypothetical combination above). Strain nowhere mentions silicon as a dopant ion, and Kalnitsky nowhere mentions boron, phosphorous, germanium, or arsenic as dopant ions.

In fact, in view of the teachings of Strain and Kalnitsky, the skilled artisan would instead be motivated to implant any dopant ion into silicon dioxide (i.e., after the oxidation of the substrate) instead of silicon. Both Strain and Kalnitsky recognize potential problems with segregation/migration of the dopant ion in silicon upon subsequent oxidation to form silicon dioxide. See Strain, col. 3, lines 4-7 ("Phosphorous and arsenic, because of their very different segregation properties, might have a tendency to accumulate ahead of a growing interface of silicon dioxide."); Kalnitsky, col. 1, lines 66-68 ("[M]igration of the dopant during the oxide growth may be a problem."). Thus, the skilled artisan following the teachings of Strain and Kalnitsky would have been motivated to adopt the approach of Kalnitsky (i.e., doping into silicon dioxide) that solves a common problem of both references.

Thus, there is simply no motivation to combine Strain and Kalnitsky *in a manner that suggests the implantation of silicon into crystalline silicon*, as recited by each of the independent claims 1, 15, and 17.

E. Rejection of Claims 1-10 and 14-17 over Strain in view of Kalnitsky and Kase

The action asserts that "it would have been obvious to modify the process of forming a waveguide taught by Strain '299 by using silicon ion doping first as taught by Kase et al. '794 to form preamorphized regions followed by the boron, arsenic, or phosphorous dopants to control diffusion." See pp. 4-5 of the action. Thus, the action essentially asserts the obviousness of a combination in which (1) a silicon substrate is provided (as taught by Strain), (2) silicon is implanted into the entire top layer of the silicon substrate to form a surface layer of amorphous/disordered silicon (as taught by Kase), and (3) a dopant selected from boron, phosphorous, germanium, and arsenic is implanted into waveguide regions of the surface layer of amorphous silicon (as taught by Strain).

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A surface layer of amorphous silicon is neither "a selectively-amorphized silicon layer" (independent claims 1 and 17) nor "a crystalline layer comprising regions of amorphized silicon" (independent claim 15). These recited claim features refer to the spatial variation between amorphous and crystalline silicon regions *along the length of the optical device*, and Kase teaches only a surface layer of amorphous silicon that does not vary along the length of the optical device. Thus, even if Strain, Kalnitsky, and Kase are combined in the manner suggested by the action, the proposed combination fails to teach or suggest all claimed limitations, and no *prima facie* case of obviousness exists.

Further, there is no motivation or suggestion to modify the teachings of Kase such that silicon would be implanted in a lengthwise spatial pattern similar to that of the boron, phosphorous, germanium, or arsenic dopant. For the amorphous silicon to be effective in limiting the diffusion of a later implanted dopant, the dopant must be completely contained within the amorphized region. See Kase, col. 13, lines 31-49 (indicating that the substrate is implanted with silicon to a depth greater than the subsequent dopant) and col. 14, lines 3-5 (indicating that the dopant must stay within the amorphized region to prevent diffusion). Thus, the lengthwise continuous implantation of silicon taught by Kase prevents diffusion in both the depth and lengthwise directions. If Kase were modified so that silicon were implanted only at the same lateral locations as the subsequent dopant, diffusion in the lengthwise direction would not be controlled. Accordingly, there is no motivation to modify the teachings of Kase with respect to its spatial implant pattern of silicon.

F. Rejection of Claims 1-11 and 14-18 over Strain in view of Kalnitsky and Kase, further in view of Koblinger and Coronel

This rejection expands upon the previous rejection over Strain, Kalnitsky, and Kase with the addition of Koblinger and Coronel for their teachings related to etching steps and chemicals. Koblinger and Coronel do not remedy the underlying deficiencies of Strain, Kalnitsky, and Kase, and thus no *prima facie* case of obviousness exists based on these applied references.

G. Rejection of Claims 1, 2, 7-10, and 14-16 over Dood in view of Kusunoki

The action asserts that "it would have been obvious to modify the process of forming the photo mask taught by Dood et al. . . . by using the resist masking process and the silicon implantation/bombardment taught by Kusunoki et al. '904." Thus, this rejection requires some motivation or suggestion to replace the xenon dopant of Dood with the silicon dopant of Kusunoki.

This rejection relies on an unsupported assertion of equivalence between the use of silicon and xenon dopants when forming amorphous silicon in optical devices such as waveguides. See p. 6 of the action ("[Silicon and xenon ions] are evidenced in the art to have

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the same effect and both are ion implantation processes."). While the substitution of equivalents known for the same purpose can support an obviousness rejection (MPEP § 2144.06), the equivalency must be recognized in the prior art, and cannot be based on the applicant's disclosure or the mere fact that the components at issue are functional or mechanical equivalents. *In re Ruff*, 256 F.2d 590, 599 (CCPA 1958) ("To sum it all up, *actual equivalence is not enough* to justify refusal of a patent on one member of a group when another member is in the prior art. The *equivalence must be disclosed in the prior art* or be obvious within the terms of Section 103." (emphases added)).

At most, the prior art of record establishes that silicon and xenon can be used as dopant ions. Dood teaches the use of only xenon in forming amorphous silicon waveguides, and Kusunoki teaches the use of only silicon or germanium in forming an amorphous silicon layer in a field effect element. Nothing in the prior art suggests that silicon and xenon are equivalents in general, let alone equivalents for the purpose of amorphizing crystalline silicon as recited in the claims. Thus, the action fails to set forth any evidence supporting a conclusion of equivalence, and the obviousness rejection is improper for this reason alone. *In re Ruff*, 256 F.2d at 599.

Moreover, even if it is true that silicon and xenon dopant ions "have the same effect," the obviousness rejection is still deficient because there is no reason why the skilled artisan would have selected silicon as a substitute dopant for xenon. See *In re Kotzab*, 217 F.3d at 1371. Having the "same effect" may demonstrate a reasonable expectation of success (i.e., the third prong of a *prima facie* case of obviousness), but it has no bearing on the showing of a suggestion or motivation to make the substitution (i.e., the second prong of a *prima facie* case). Thus, there is simply no motivation to combine Strain and Kalnitsky *in a manner that suggests the implantation of silicon into crystalline silicon*, as recited by each of the independent claims 1, 15, and 17.

H. Rejection of Claims 1-3 and 6-18 over Dood and Kusunoki in view of Strain, Kalnitsky, and Kase

This rejection expands upon the previous rejection over Dood and Kusunoki with the addition of Strain, Kalnitsky, and Kase. The action asserts that "it would have been obvious to modify the processes rendered obvious by the combination of Dood et al. . . . and Kusunoki et al. '904 by using silicon ion doping first as taught by Kase et al. '794 to form preamorphized regions followed by the boron, arsenic, or phosphorous dopants to control diffusion." See p. 7 of the action. Thus, the action essentially asserts the obviousness of a combination in which (1) a silicon substrate is provided (as taught by Dood), (2) silicon is implanted into the entire top layer of the silicon substrate to form a surface layer of amorphous/disordered silicon (as taught by Kase), (3) a dopant selected from boron, phosphorous, germanium, and arsenic is implanted into waveguide regions of the surface layer of amorphous silicon (as taught by

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Strain), and (4) silicon is implanted into the same waveguide regions of the surface layer of amorphous silicon (i.e., substituting the xenon of Dood with the silicon of Kusunoki).

This proposed combination is nonsensical on its face because it involves a redundant step. Specifically, the silicon implantation step (4) is intended to amorphize only the waveguide regions of the silicon substrate surface layer, yet the entire surface layer has already been amorphized by step (2).

This rejection has the same deficiency discussed above in Section I.G (i.e., Dood and Kusunoki provide no motivation to replace the xenon dopant with silicon), and none of Strain, Kalnitsky, or Kase remedy this deficiency by suggesting the equivalence of silicon and xenon.

This rejection also has the same deficiency discussed above in Section I.H (i.e., Kase teaches a continuously amorphized silicon layer to control diffusion while the claims recite, e.g., selectively-amorphized silicon layer), and none of the other references remedy this deficiency by suggesting that dopant diffusion could be controlled without a continuous amorphous silicon layer.

I. Rejection of Claims 1-18 over Dood and Kusunoki in view of Strain, Kalnitsky, and Kase, further in view of Koblinger and Coronel

This rejection expands upon the previous rejection over Dood, Kusunoki, Strain, Kalnitsky, and Kase with the addition of Koblinger and Coronel for their teachings related to etching steps and chemicals. Koblinger and Coronel do not remedy the underlying deficiencies of the previous references, and thus no *prima facie* case of obviousness exists based on these applied references.

Given these shortcomings, it is respectfully submitted that the claimed invention is unobvious. Accordingly, reconsideration and withdrawal of the rejections are requested.

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CONCLUSION

In view of the foregoing, reconsideration and withdrawal of the rejections, and allowance of all pending claims 1-18 are respectfully requested.

Should the examiner wish to discuss the foregoing, or any matter of form or procedure in an effort to advance this application to allowance, the examiner is urged to contact the undersigned attorney.

Respectfully submitted,

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